Family edition

Flight Lab: Steer It Down the Hallway

Ages 11-14 · about 45 minutes, in one sitting

Your child learns to steer a paper plane in Flight Lab by bending one back edge more than the other, then flies it the whole length of a school hallway.

What you need

- A computer or Chromebook with a current browser, and a mouse or trackpad.
- The lesson link: mytekdev.com/try/flightlab?lesson=steer-it-down-the-hallway&ref=fam-flightlab-3. No account, no email and nothing to install.

Before you start: try it once yourself

Open mytekdev.com/try/flightlab?lesson=steer-it-down-the-hallway&ref=fam-flightlab-3. A short guide opens over the app. It is the classic dart as it comes: back edges 12 degrees up on both sides. To set an exact number, click a slider once and press the left and right arrow keys.

1. **A turn.** On `Shape`, set Left back edge 10 and Right back edge 14. On `Fly`, press `From above` under Watch and `Throw it`: it tips its right wing down and curves gently right, about a foot by the time it lands: "A turn: 22 ft". Swapped, it turns left just as far. Under Things to try, A turn on purpose gets a check mark.
2. **Too much.** Left 8, Right 16: "A roll off to one side: 16 ft".
3. **The hallway.** On `Shape`, press `Put it back as it came`. On `Fly`, pick Hallway under Where and Down the hallway under Contest. Throw it: a glide of 24 ft, and the bench says how far short it stopped. At How hard 4 it hits the ceiling. One way through: both back edges at 4, How hard 6, Angle level: "All the way down the hallway!" Another: both back edges at 2, How hard 7, Angle as it came. There are others.

> The moment that lands is the swap: children who predicted it see the rule hold both ways. Keep the turns to a few degrees apart: a 2 degree difference barely curves, and 8 degrees rolls it.

The ideas, in plain words

The wings lift at right angles to themselves. When a plane tips one wing down, called a bank, part of that lift points sideways and pulls the plane round in a curve. A bicycle does the same thing when you lean into a corner. A back edge bent up more pushes that side down harder and it lifts less, so it drops, and that is the side the plane banks toward: it turns toward the edge bent up more.

Bent very differently, the plane banks so far that the wings no longer hold it up, and it rolls off to one side. Real pilots turn by banking a little and holding it. In the hallway, more speed carries the plane farther, but a fast plane with its nose held up climbs into the ceiling. Less bend lets it fly fast and level instead.

Common mistakes: the plane turns away from the edge bent up more; steering by aiming the throw; changing several things at once in the hallway. Flight Lab works out each flight from the folded shape and the throw. A few of its numbers are our own, set where no published measurement exists, so a real paper dart lands near the distances on screen, not exactly at them. Real throws also vary more than the app's, real paper softens with use, and the app never shows a stall: its short paper wings tip over before they would stall. The turn rule holds at the wing angles the app allows; the Wing angle slider stops before it would fail.

Do it together

1. Open mytekdev.com/try/flightlab?lesson=steer-it-down-the-hallway&ref=fam-flightlab-3 together. A short guide opens over the app. Press `Shape` and set Left back edge to 10 and Right back edge to 14. Press `Fly`, press `From above`, and `Throw it`.

   > **You'll know it worked when:** It curves gently right: "A turn: 22 ft".

2. Swap the two numbers and throw again. Then try Left 8, Right 16.

   > **You'll know it worked when:** Swapped, it turns left. At 8 and 16 it rolls over: "A roll off to one side: 16 ft".

3. Press `Put it back as it came` on `Shape`. On `Fly`, pick Hallway and Down the hallway, and throw.

   > **You'll know it worked when:** It glides 24 ft and stops about 25 ft short.

4. Change one thing at a time until it reaches the end. Ask: what did you change to go farther without hitting the ceiling?

   > **If you get stuck:** Try less bend on both back edges, a harder throw, and the Angle at level.
   >
   > **You'll know it worked when:** "All the way down the hallway!"

Talk about it

Ask these while you work together. A child who has understood it can answer them without help:

- Say the rule in one sentence: which edge, which way?
- Why does a plane that tips its wing to one side go that way?
- What happened at 8 and 16, and why not bank a lot to turn faster?
- Your plane hit the ceiling. What will you change, and why that?
- Which single change got you closest to the end?

> The second question is the real test: a child who says part of the lift points sideways when the wing tips has the idea.

For younger and older kids

Younger: For a younger child, turn it both ways together, then work on the hallway as a team.

Older: For a teenager, find two different ways down the hallway and explain why each works.

Keep going

- Find a second way down the hallway that is different from your first.
- Try Left 11, Right 13, then Left 9, Right 15. How small a difference still turns it?
- Pick Land in the ring under Contest in the gym and land it in the ring three times in a row.

Bring it into other subjects

- Math: the hallway is 15 m long. Convert it to feet and to your own steps.
- Building: fold a real dart, bend one back edge up a little more, and throw it gently in a hallway. Does it turn the way the app says?
- History: find out how the Wright brothers turned their 1903 Flyer by twisting its wings.
- English: write the hallway log as a short story of the attempts, in order, with what each one taught you.

For your records

Ready to copy into an hour log, a portfolio or a transcript.

LESSON	Flight Lab: Steer It Down the Hallway
SUBJECTS	Physical science, Engineering
TIME	45 minutes
WHAT WE DID	Steered a paper plane on purpose, explained how banking turns it, and met a design challenge with limits by changing one thing at a time.
SKILLS PRACTICED	How planes turn; Engineering design; Testing one change at a time

Activity sheet (optional)

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/flightlab?lesson=steer-it-down-the-hallway

Essential question: How do you steer a paper plane where you want it to go?

Warm-up: How do you think a paper plane turns? _____

1. **Vocabulary.** Bank, roll, criteria, constraints, iterate: write each in your own words.

2. **The rule.** Left 10, Right 14: it turned _____. Swapped: _____. Left 8, Right 16: _____. The rule: it turns toward _____.

3. **The hallway log.** For each throw: what I changed _____; what it did _____; how far short, or what it hit _____. One throw on each line.

1. What did you change to get all the way down the hallway? Why did each change help?

2. Why does a plane turn when it tips one wing down?

Quick check

Name: _____

1. The right back edge is bent up more than the left. The plane turns (A) left (B) right (C) not at all

2. Both back edges are bent very differently. The plane will most likely (A) turn faster and land farther (B) roll over and fall (C) fly straight

3. In the hallway, a harder throw hit the ceiling. Name one change that could fix it, and explain why.

Answers

QUESTION	ANSWER	WHY
1	B	It turns toward the edge bent up more: that side lifts less, drops, and the plane banks toward it.
2	B	It banks so far that the wings no longer hold it up, and it rolls off to one side.
3	Less bend, or a level throw	Less bend on both back edges lets a fast plane fly level instead of holding its nose up and climbing; a level angle stops it aiming up. "Throw it gentler" is half: it fixes the ceiling, but the plane lands short.

If your state or umbrella school asks, this lesson covers NGSS MS-ETS1-2, NGSS MS-ETS1-4.

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The app this lesson uses is free and runs in the browser, with nothing to install and no account needed. It is at mytekdev.com.

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